

1 **WHAT IS CLAIMED IS:**

2 1. An uninterruptible power supply having an input connected to an input power
3 source and an output connected to a critical load, the uninterruptible power supply
4 comprising:

- 5 a) a utility disconnect static switch comprising two silicon controlled
6 rectifiers connected in anti-parallel coupled between the input and an
7 input bus;
8 b) a battery bus;
9 c) an inverter coupled between the battery bus and the output; and
10 d) an inverter controller that, upon detection of an input power source fault
11 causing an input voltage magnitude increase, controls the inverter to
12 generate on the input bus a voltage of the same polarity and greater
13 magnitude than the input voltage, thereby commutating the utility
14 disconnect static switch.

15
16 2. The uninterruptible power supply of claim 1 further comprising:

- 17 a) a transformer having first and second windings, the first winding series
18 coupled between the utility disconnect static switch and the output,
19 and the second series winding having a first terminal coupled to
20 ground;
21 b) a series inverter coupled between a second terminal of the second winding
22 and the battery bus; and
23 c) a series inverter controller that, upon detection of an input power source
24 fault causing an input voltage magnitude increase, controls the series
25 inverter to generate on the input bus a voltage of the same polarity and
26 greater magnitude than the input voltage, thereby commutating the
27 utility disconnect static switch.

- 1 3. A method of preventing fault propagation through a utility interactive UPS having
2 an inverter and a utility disconnect static switch with an input terminal supplied with an
3 input power signal and an output terminal, the method comprising the steps of:
4 sensing a characteristic of the input power signal;
5 detecting a change in the sensed characteristic indicating a fault that causes an
6 increase in the voltage of the input power signal;
7 controlling the inverter to generate on the output terminal of the utility disconnect
8 static switch a voltage having a polarity the same as and a magnitude
9 greater than the faulted input voltage, thereby commutating the static
10 switch.
11
12 4. The method of claim 3 wherein the UPS comprises a second inverter, the method
13 further comprising:
14 controlling the second inverter to generate on the output terminal of the utility
15 disconnect static switch a voltage having a polarity the same as and a
16 magnitude greater than the faulted input voltage, thereby commutating the
17 static switch.
18
19 5. The method of claim 3 wherein the sensed characteristic is a voltage across the
20 static switch.
21
22 6. The method of claim 3 wherein the sensed characteristic is a current through the
23 static switch.
24
25 7. The method of claim 4 wherein the sensed characteristic is a voltage polarity
26 across the static switch.
27
28 8. The method of claim 4 wherein the sensed characteristic is a current direction
29 through the static switch.
30

1 9. An uninterruptible power supply having an input connected to an input power
2 source and an output connected to a critical load, the uninterruptible power supply
3 comprising:

- 4 a) a utility disconnect static switch coupled between the input and an input
5 bus, the switch two silicon controlled rectifiers connected in anti-
6 parallel;
7 b) a series inverter coupled between the input bus and a battery bus;
8 c) a primary inverter coupled between the battery bus and the output; and
9 d) a series inverter controller that, upon detection of an input power source
10 fault causing an input voltage magnitude increase, controls the series
11 inverter to generate on the input bus a voltage of the same polarity and
12 greater magnitude than the input voltage, thereby commutating the
13 utility disconnect static switch.
14

15 10. A method of preventing fault propagation through a utility interactive UPS having
16 a series inverter and a utility disconnect static switch with an input terminal supplied with
17 an input power signal and an output terminal, the method comprising the steps of:

- 18 sensing a characteristic of the input power signal;
19 detecting a change in the sensed characteristic indicating a fault that causes an
20 increase in the voltage of the input power signal;
21 controlling the series inverter to generate on the output terminal of the utility
22 disconnect static switch a voltage having a polarity the same as and a
23 magnitude greater than the faulted input voltage, thereby commutating the
24 static switch.
25

26 11. An uninterruptible power supply having an input connected to an input power
27 source and an output connected to a critical load, the uninterruptible power supply
28 comprising:

- 29 a) a utility disconnect static switch comprising two gate commutated
30 switching devices connected in anti-parallel coupled between the input
31 and an input bus;

09322944-060104
T07030-44622860

- 1 b) an utility disconnect static switch controller that, upon detection of an
2 input power source fault causing an input voltage magnitude increase,
3 opens the gate commutated switching devices.
4 c) a clamping circuit coupled to the gate commutated switching devices to
5 minimize the transient voltage caused by opening the fast utility
6 disconnect static switch.

7
8 12. The uninterruptible power supply of claim 11 wherein the gate commutated
9 switching devices are power transistors.

10
11 13. The uninterruptible power supply of claim 11 wherein the gate commutated
12 switching devices are gate turn off thyristors.

13
14 14. The uninterruptible power supply of claim 11 wherein the clamping circuit further
15 comprises:

- 16 a first diode having a cathode coupled to an input side of the fast utility
17 disconnect static switch and an anode coupled to a negative battery bus;
18 a second diode having an anode coupled to the input side of the fast utility
19 disconnect static switch and a cathode coupled to the positive battery bus;
20 a third diode having an anode coupled to an output side of the fast utility
21 disconnect static switch and a cathode coupled to the positive battery bus;
22 and
23 a fourth diode having a cathode coupled to the output side of the fast utility
24 disconnect switch and an anode coupled to the negative battery bus.

25
26 15. The uninterruptible power supply of claim 11 wherein the clamping circuit further
27 comprises:

- 28 a first diode having a cathode coupled to an input side of the fast utility
29 disconnect static switch and an anode coupled to a negative terminal of a
30 capacitor;

1 a second diode having an anode coupled to the input side of the fast utility
2 disconnect static switch and a positive terminal of the capacitor;
3 a third diode having an anode coupled to an output side of the fast utility
4 disconnect static switch and a cathode coupled to the positive terminal of
5 the capacitor; and
6 a fourth diode having a cathode coupled to the output side of the fast utility
7 disconnect switch and an anode coupled to the negative terminal of the
8 capacitor.

9
10 16. The uninterruptible power supply of claim 11 wherein the clamping circuit further
11 comprises:

12 a first diode having an anode coupled to an input side of the fast utility disconnect
13 static switch and a cathode coupled to a first terminal of a capacitor;
14 a second diode having a cathode coupled to the input side of the fast utility
15 disconnect static switch and an anode coupled to a second terminal of the
16 capacitor;
17 a third diode having a cathode coupled to the first terminal of the capacitor and an
18 anode coupled to ground; and
19 a fourth diode having an anode coupled to the second terminal of the capacitor
20 and a cathode coupled to ground.

21
22 17. The uninterruptible power supply of claim 11, wherein the clamping circuit
23 further comprises:

24 a first diode having an anode coupled to an input side of the fast utility disconnect
25 static switch and a cathode coupled to a first terminal of a first capacitor;
26 and
27 a second diode having a cathode coupled to the input side of the fast utility
28 disconnect static switch and a cathode coupled to a second terminal of a
29 second capacitor;
30 wherein the second terminal of the first capacitor and the first terminal of the
31 second capacitor are coupled to ground.

1
2 18. The uninterruptible power supply of claim 11, wherein the clamping circuit
3 further comprises:

4 a first voltage limiting diode having a cathode coupled to an input side of the fast
5 utility disconnect static switch; and

6 a second voltage limiting diode having an anode coupled to an anode of the first
7 voltage limiting diode and a cathode coupled to ground.
8

9 19. A method of preventing fault propagation through a utility interactive UPS having
10 a utility disconnect static switch comprising two gate commutated switching devices
11 coupled in anti-parallel, the static switch having an input terminal supplied with an input
12 power signal, the method comprising the steps of:

13 sensing a characteristic of the input power signal;

14 detecting a change in the sensed characteristic indicating a fault that causes an
15 increase in the voltage of the input power signal;

16 opening the static switch to disconnect the input power signal from the UPS.
17

18 20. The method of claim 19 wherein the sensed characteristic is a voltage across the
19 static switch.
20

21 21. The method of claim 19 wherein the sensed characteristic is a current through the
22 static switch.